DESCRIPTION OF THE COURSES

- Course code: ELR1370
- Course title: Electromagnetic field theory
- Language of the lecturer: Polish

Course form	***Lecture***	***Classes***	***Laboratory***	***Project***	***Seminar***
*Number of hours/week**	*2*	*1*			
*Number of hours/semester**	*20*	*10*			
Form of the course completion	*exam*	*written test*			
ECTS credits	*3*	*2*			
Total Student's Workload	*90*	*60*			

- Level of the course (basic/advanced): basic
- Prerequisites: Mathematical Analysis 1 & 2, Physics
- Name, first name and degree of the lecturer/supervisor: Bronisław Świstacz, PhD
- Names, first names and degrees of the team's members:
    1. Adam Gubański, PhD
    2. Jerzy Piotrowicz, PhD
    3. Edmund Motyl, Prof.
    4. Janina Pospieszna, Prof. nadzw.
- Year:..II..... Semester:.....3.....
- Type of the course (obligatory/optional): obligatory
- Aims of the course (effects of the course):

  Effects of education – know-how and competences: description of basic problems from range of electromagnetic field, formulations of field equations, computation of field distribution.
- Form of the teaching (traditional/e-learning): traditional
- Course description:

Electric charge distributions, electric field intensity, capacitor systems. Current flow field, resistance systems. Magnetic field intensity, magnetic flux, wave equation, magnetic circuits.

- Lecture:

Particular lectures contents	*Number of hours*
1. The point charge distribution; the continuous charge density distributions. Coulomb's law and the electric field intensity, the potential, the voltage, the electric flux. Streamlines, the line segments, equipotential surface, units.	2
2. Field of the point and continuous charge distributions. The Gauss' law in the differential and integral form in a vacuum. Some differential	2

operators such as gradient, divergence, curl and nabla operator.	
3. The polarization vector, the electric susceptibility, .the permittivity. The electric flux density vector. Boundary conditions for perfect dielectrics materials. The continuous and discontinuous conditions at the boundaries.	2
4. The capacitance, the parallel – plate capacitor, the cylindrical and spherical capacitor. An analysis of capacitor systems. The linear form of a potential function of system of electrodes.	2
5. The work in the electric field, energy density in the electrostatic field and the divergence .theorem, the potential energy of system of electrodes, the energy in a capacitor.	2
6. Poisson's and Laplace's equation and the boundary conditions as well as the uniqueness theorem. The Gauss's law in the spherical, cylindrical and uniform electric field.	2
7. Conductors, electric charge in motion, current, the current density, the point form of Ohm's law and the thermal energy density. The stationary state equations of current flow field in the integral and differential form. The generalized form of Ohm's law for conductor volume and the total energy. The boundary conditions for conductors. The resistance problem in the cartesian, cylindrical and spherical coordinate system. Resistance as a temperature function. Kirchhoff's laws and an analysis of resistance systems.	2
8. The magnetic field. The Lorentz's formula, the magnetic flux density vector, magnetic flux. The magnetic forces. The differential magnetic dipole moment of a bound current. The vector potential.	2
9. Biot-Savart-Laplace's law. Ampere's circuital law in a vacuum. The scalar and vector potential problem for a vacuum. Forces between differential current elements and Grassman's law.	2
10. Magnetic field in materials., the magnetization vector. The magnetic field .intensity. Ampere's circuital law in materials. The magnetic circuit. The Faraday theory of electricity and magnetism. The electric – magnetic field The displacement current density. Maxwell's equations.	2

- Classes – the contents:

  The determination of the electric field intensity and potential distributions for the given charge distributions. The determination of the force, work and potential energy. The calculation of the given capacitor systems. The determination of the current density and of the electric field intensity for the given current flow conditions. The determination of the resistance in the cylindrical and spherical coordinate system. The determination of the magnetic flux density and of the magnetic field intensity. The calculation of the given magnetic circuits.
- Seminars – the contents:
- Laboratory – the contents:

  The investigation of the RC filters. The investigation of the RLC series connection. The investigation of the RLC parallel – series circuit. The investigation of the three – phase circuit with the star and delta connection. The investigation of the LM inductance system. The four terminal network.
- Project – the contents:
- Basic literature:

1. R. Sikora - ***Teoria Pola Elektromagnetycznego*** - WNT 1997
2. A. Skopec i Inni - ***Elektryczność i Magnetyzm*** - Skrypt PWr. 1993.
3. R. Kurdziel – ***Podstawy elektrotechniki*** – WNT 1973.
4. A. Łuczycki, A. Skopec – ***Elektrotechnika teoretyczna - t2 Teoria pola dla elektryków***, Skrypt, PWr. 1992

- Additional literature:

1. J. D. Jackson – ***Classical Electrodynamics –*** third edition, John Wiley & Sons, INC, 2001
2. John D. Kraus, Daniel A. Fleisch – ***Electromagnetics with Applications*** – fifth edition, McGraw-Hill International Editions, 1999
3. 3. W. Michalski – ***Elektryczność i magnetyzm – Zbiór zagadnień i zadań*** – Oficyna Wydawnicza PWr, 2004
4. M. Krakowski – ***Elektrotechnika teoretyczna- t2 – Pole elektromagnetyczne,*** PWN, 1979.

- Conditions of the course acceptance/credition: Passed examination, passed colloquium, satisfactory evaluation of reports.

***** - depending on a system of studies